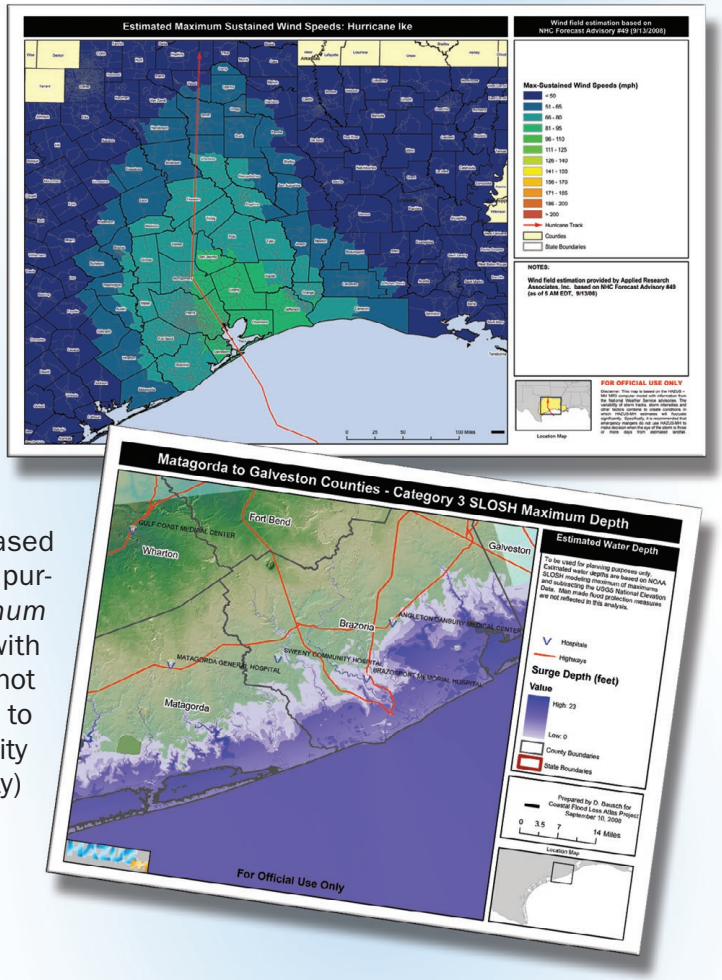
FEMA

Using HAZUS-MH to Support Response to Hurricane Ike

HAZUS-MH played an important role in FEMA's response to Hurricane Ike. In the days leading up to Ike's landfall on September 13, 2008, FEMA's Mapping and Analysis Center (MAC) convened conference calls with federal and state partners to assess the potential impacts of the storm on Texas, Louisiana and Mississippi. The calls brought together subject matter experts on hurricane hazards, modeling, remote sensing, and disaster operations to coordinate analyses of potential consequences of Ike.



The first HAZUS-MH runs were carried out by FEMA's modeling team on September 11, 2008 (two days prior to landfall). For this mission, the HAZUS-MH team gave priority to analyses that would support the missions of FEMA's Individual Assistance Program and the Small Business Administration – including mass care and housing recovery.

FEMA's HAZUS-MH team generated a suite of map-based products following each NHC advisory. For planning purposes, a key HAZUS-MH output is *Estimated Maximum Sustained Wind Speeds*. When used in conjunction with surge analysis, this template presents a useful snapshot of the exposure of the population and essential facilities to high winds and storm surge from Hurricane Ike. The ability to depict estimated damages on a regional (multi-county) scale is an added advantage.

Using HAZUS-MH to Support Emergency Support Function #6 (ESF #6)

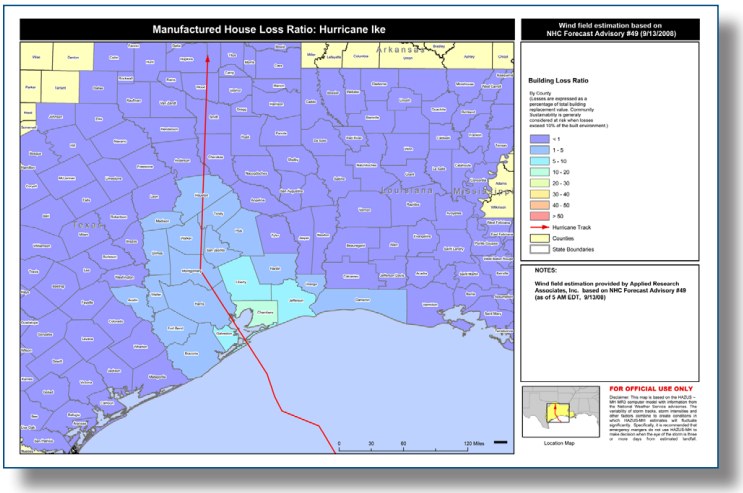
Recent hurricane disasters demonstrate the vulnerability of housing to high winds and storm surge. In many respects, the pace of recovery is a function of the ability to repair or replace housing, which in turn is a key to business recovery.

HAZUS-MH is being used by FEMA's Individual Assistance (IA) Program and the Small Business Administration (SBA) for pre-disaster planning and post-disaster assessment of loss. There are several HAZUS-MH outputs that

can be used for planning and scaling of mission requirements under ESF #6 – Mass Care, Emergency Assistance, Housing and Human Services. These include:

- **Identification of Population at Risk**, expressed as quantification of population that has been exposed to the effects of the hazard, including key population attributes (age, gender, income) that influence household vulnerability.
- **Estimates of Residential Damage**, expressed as the percentage of residential building square footage with at least moderate damage.
- **Estimates of Displaced Households**, expressed as number of households who have been displaced from their dwellings due to damage or loss of power or water.
- **Estimates of Short-Term Shelter Requirements**, expressed as the estimated number of individuals who require short-term public sheltering as a result of the hazard.

HAZUS-MH is FEMA's multi-hazard loss estimation model. It has been used since 2002 to support hurricane disaster operations. The model uses National Hurricane Center advisories to estimate area of impact, economic losses, building losses, damage to essential facilities (police, fire, hospitals, emergency operations centers, schools), and other consequences of hurricane winds. Given the variability of storm tracks, storm intensities and other factors, the model is most accurate at landfall, when final windfield data is captured. For this reason, FEMA recommends that emergency managers not use the model for decisions when the eye of the storm is three or more days from estimated landfall. For additional information on HAZUS-MH and its applications for disaster response, go to www.fema.gov/plan/prevent/hazus.



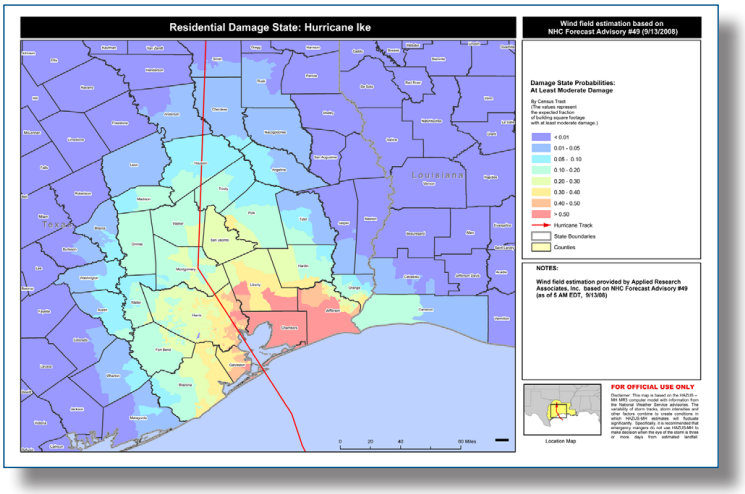
Among the outputs from the HAZUS-MH team was Residential Damage State: Hurricane Ike (Advisory 49 on 9/13/2008) which shows the probability of at least moderate damage to single family residents from Hurricane Ike wind. The analysis is aggregated at the census tract level, and shows counties (and portions of impacted counties) that experienced a greater than 50 percent probability of at least moderate damage from Hurricane Ike winds. When combined with surge analysis and estimated building counts, this analysis provided IA and SBA analysts with initial estimates of the scale of residential damage by county. This information has many uses, including initial estimates of the number of IA Preliminary Damage Assessment Teams that are needed. Estimates of residential damage were also carried out for Manufactured Homes, which is the most vulnerable category of residential building stock.

Using HAZUS-MH to Support Long-Term Community Recovery and Mitigation (ESF #14)

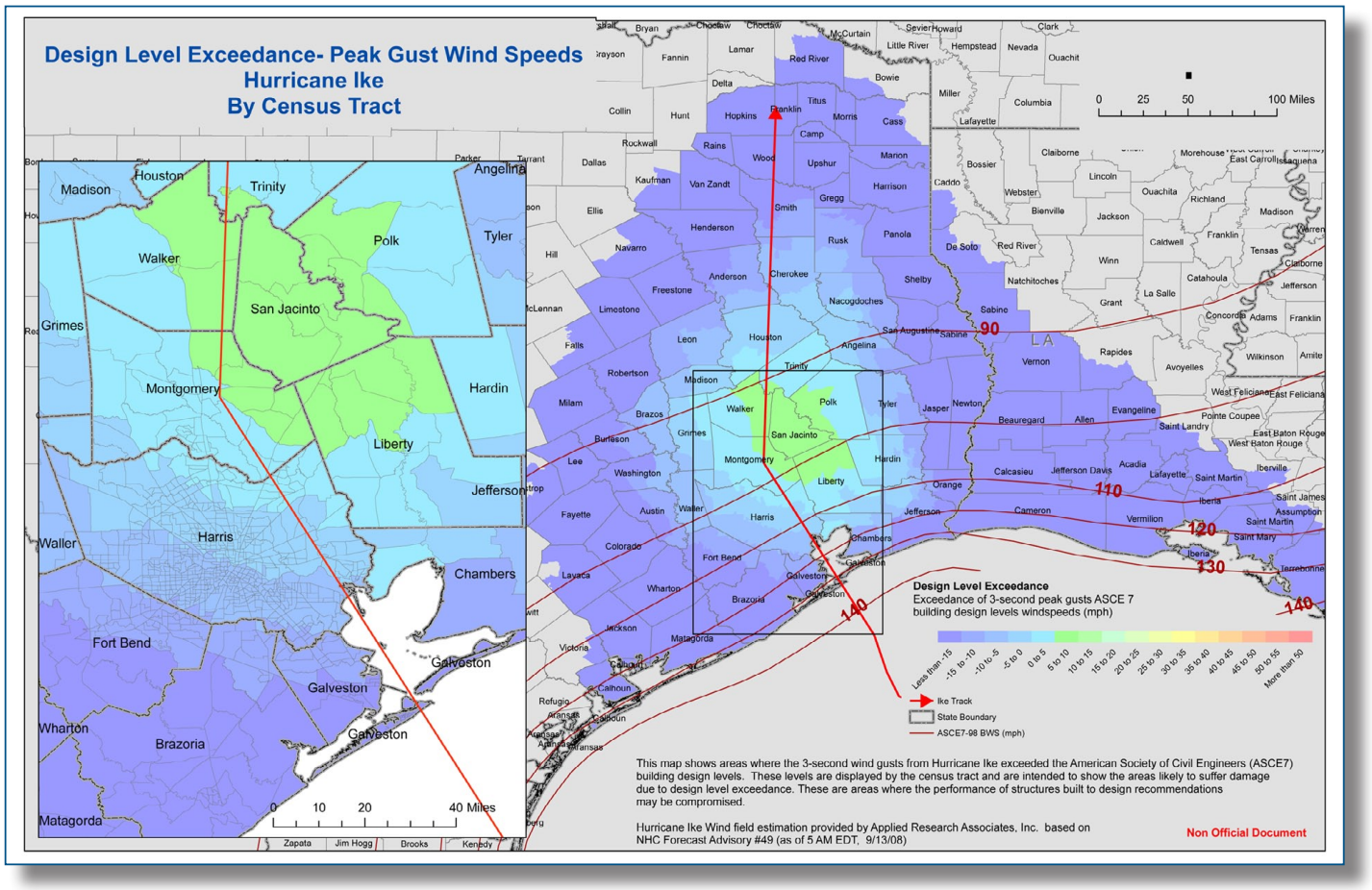
HAZUS-MH can also be used to support long-term community recovery and mitigation through ESF #14. The model has three core capabilities that can contribute to the implementation of ESF #14. HAZUS-MH can:

- **Measure** potential effects of a disaster.
- **Simulate** benefits and losses potentially avoided through the implementation of mitigation measures.
- Assess County Loss Ratios, which measures residential loss as a percentage of total residential building value.

During Hurricane Ike, HAZUS-MH was used to estimate Building Loss Ratios. Community sustainability and ability to recover from a major disaster is at risk when losses exceed 10 percent of the built environment. Using this threshold, HAZUS-MH determined that Chambers County faces the greatest challenges in recovery from Ike (Building Loss Ratio of 24 percent). A second tier of twelve counties – including Galveston – had Building Loss Ratios that measured between 5 and 10 percent



One of the most useful indicators of building performance in a hurricane is when wind speeds exceed building design. In Hurricane Ike, the team mapped *Design Level Exceedance – Peak Gust Wind Speeds* that shows areas where the 3-second wind gusts from Ike exceeded the American Society of Civil Engineers (ASCE7) building design levels. Five Texas counties – Walker, Montgomery, Polk, San Jacinto and Liberty – have the highest concentration of structures that are likely to be compromised due to wind speeds exceeding recommended design levels for that area. This analysis is valuable. It can be used to identify areas with high likelihood of damaged structures, and to scale mission requirements for damage assessment teams.



In summary, Hurricane Ike presented another opportunity for FEMA to demonstrate the value of HAZUS-MH as a regional loss estimation tool that can be used to support pre- and post-landfall impact analysis in a major hurricane operation. During Ike, priority was given to assessing potential impacts on housing in support of FEMA's Individual Assistance mission. In the meantime, lessons learned from Ike will be incorporated into future applications of HAZUS-MH for hurricane operations.